only one plastic layer coated on one side and furthermore it is not a composite layer, such as fibers embedded in a resin matrix.

The prior art electrical vehicles often have high pressure air filled tires, which can blow out and cause accidents.

Since the electric motors used in prior art vehicles do not generate appreciable quantities of heat and because the use of electricity for heating and cooling of the vehicle passenger compartment may be impractical due to the high energy drain on the batteries, prior art electric vehicles use auxiliary gasoline, diesel or kerosene fueled heating/cooling systems, but these systems continue pollution of the atmosphere and defeat the non-pollution purpose of electric vehicles.

In addition, prior art electric vehicles have very limited ranges, not only because of their body weight and high drag, but also because they utilize low specific energy density batteries.

Hybrid electric vehicle construction has been proposed, but the non-electric portion is not free from atmospheric pollution.

An engine which only reduces the atmospheric pollution and extends the range is proposed in U.S. Patent #4,031,865 of Dufour which discloses a hydrogen generating cell used only as a supplement to a conventional gas fuel, such as gasoline, to improve the efficiency of the engine. Dufour does not teach non-polluting, hydrogen generating system which is consuming only water, or only water and hydrogen.

Fig.9 is a side elevational view of another embodiment of electric vehicle;

Fig.10 is a horizontal sectional schematic view of another embodiment of electric vehicle taken approximately on the line 10-10 of Fig. 11;

Fig.11 is a side elevational view of another embodiment of electric vehicle;

Fig.12 is a horizontal sectional schematic view of another embodiment of electric vehicle taken approximately on the line 12-12 of Fig. 13;

Fig.13 is a side elevational view of another embodiment of electric vehicle;

Fig.14 is a front elevational view of the electric vehicle of the invention shown in Fig. 13;

Fig.15 is a simplified schematic diagram illustrating the principle of the hydrogen fueled optional additional propulsion system;

Fig.16 is an axionometric view of an electric vehicle frame formed of bonded extrusions and fittings;

Fig.16A is a simplified schematic diagram illustrating modified Kipp type reactor systems;

Fig.17 is a top elevational view of a body panel having a honeycomb core composite sandwich construction;

Fig.18 is a vertical sectional view of a body panel taken approximately on the line 18-18 of Fig. 17;

Fig.19 is a top elevational view of a body panel having a foam core composite sandwich construction;

of water, which may be produced by action of the electric current generator 104, and/or the hydrogen may be produced on demand only by other sources, such as a controlled chemical reaction in an optional reactor 93 of well known type, such as a Kipp type reactor generating hydrogen, but which may be using for example reaction of a metal catalyst, such as high surface ruthenium metal catalyst, contacting a non-flammable and stable solution of sodium borohydride in water. As shown in Fig. 16A, the Kipp reactor 93 may be modified by replacing the porous membrane with a screen 164A, replacing the metal hydride in the chamber 165 with the metal catalyst 166 coated on ion exchange resin beads, and replacing the water in the storage tank 167 with the ~~NaBH4~~ $NaBH_4$ solution in water 168. Screen 164B and control valves 169,170 and 171 may be added. This reaction produces borax waste material, but the system is safe and has high energy density. This system in combination with the hydrogen-electric hybrid vehicle is another embodiment of the invention.

If electrolysis of water is preferably used, then the hydrogen tank 103 and/or the reactor 93 may be replaced, or assisted by a hydrogen generating cell, or electrolyzer 105 of well known type, which may be electrically connected to the generator 104. Said water may have also an antifreeze agent added. The assisting water contains more hydrogen per kilogram than metal hydride, which makes possible to make the tank 103 smaller, lighter and less costly.

The hydrogen generating cell 105 may be also electrically connected to a battery 109, and/or to the batteries 96, 97 and 98, to start the system operating and also for vehicle acceleration when the demand for fuel is high. The batteries may be recharged by the generator 104 during low power cruising or standing.

A simplified schematic illustration of the principles of the system is shown in Fig. 15, which is another embodiment of the invention. Switches or relays 110, 111, 112, 115 and 116 and valve 113 control the system functions as desired.

Referring now to Fig. 15 in more detail, the simplified operation of the system is as follows:

To start the engine 87 running, the switch 111 or switch 116 is turned "ON", which delivers direct electric current from the battery 109 or from batteries 96, 97 and 98 (if they still have some electric energy stored in them), to the hydrogen-oxygen generating cells or electrolyzer 105, which produces hydrogen and oxygen gases and said gases are delivered into the combustion chamber of the engine 87 by suction of the engine pistons where the engine 87 is simultaneously being cranked either manually or by its own cranking battery with a starter (not shown). Because the hydrogen fuel and air, plus oxygen are being delivered into the engine, the engine starts running and also driving the generator 104. When the switch 110 is turned "ON", the direct electric current from the generator 104 is delivered to the cell 105 and adds to, or replaces the current from the batteries 109 or 96, 97 and 98. Then the switches 111 and/or 116 may be turned "OFF", which will disconnect the batteries from the cell 105.

If it is desired that the cell 105 is to be used to assist only to the delivery of the fuel, then the engine 87 may be started as follows:

least one motor, such as described motors 83 and 84. The preferred fuel cell system for the vehicles of the invention are the hydrogen/oxygen type, the hydrogen/air type and/or their combinations.

The preferred tires for the electric vehicles of the invention are lightweight, pressure-airless tires with honeycomb core as described in my prior U.S. Patents #5,494,090 and #5,685,926. These tires are safer because they are puncture-proof and damage resistant and they also have low rolling resistance and thus further reduce the drag on the vehicle.

The heating and/or cooling system of the passengers enclosure may be of any well-known type, but it should preferably be fueled by hydrogen to protect the environment, and more preferably, by hydrogen produced on demand only by electrolysis of water in the vehicle or by other means. Cooling and heating system may also be powered by the combustion engine 87, fueled by hydrogen.

Referring now to Figs. 23 and 24, which are another embodiments of the invention, the described vehicle body may be also built by a self-supportive sheet metal or composite shell 141, but made of a resin and the ultrahigh molecular weight polyethylene fibers and/or of a honeycomb or a foam sandwich 142, as described above, or may be constructed of other materials as described in the prior art, but the preferred described configuration and the location of the driver, the rear passenger or passengers, and the batteries or the fuel cell systems, as well as the preferred body shape and the preferred propulsion systems as described should be maintained, to achieve the most advantages of the invention.

I claim:

1. Electric vehicle construction which includes a body for carrying at least one passenger and an electric propulsion system with at least one electric motor, at least one battery, at least one electric current generator for charging said battery and/or powering said electric motor, and which is driven by at least one internal combustion engine, and a hydrogen storage system having hydrogen therein attached to said body, and which body ~~is riding~~ rides on at least two wheels with a steering system attached to said body, the improvement wherein said engine is an open to air combustion engine and is fueled only by said hydrogen.

2. Electric vehicle construction which includes a body for carrying at least one passenger and an electric propulsion system with at least one electric motor, at least one battery, at least one electric current generator for charging said battery and/or powering said electric motor, and which is driven by at least one internal combustion engine, and a hydrogen generating cell having hydrogen therein attached to said body, and which body ~~is riding~~ rides on at least two wheels with a steering system attached to said body, the improvement wherein said engine is an open to air combustion engine and is fueled only by ~~said~~ hydrogen which is produced by electrolysis of water in said hydrogen generating cell, said cell is electrically connected to said generator and also to said battery, ~~said~~ the hydrogen is not stored under pressure and is immediately consumed by said engine.

3. Electric vehicle construction which includes a body for carrying at least one passenger and electric propulsion system with at least one electric motor, at least one battery, at least one electric current generator for charging said battery and/or powering said electric motor, and which is driven by at least one internal combustion engine, a hydrogen storage system having hydrogen therein and a hydrogen generating cell which generates hydrogen by electrolysis of water, attached to said body, and which body ~~is~~ rides on at least two wheels with a steering system attached to said body, the improvement wherein

said engine is an open to air combustion engine and is fueled only by ~~said~~ the hydrogen, ~~said~~ the hydrogen being supplied from said storage system and from said hydrogen generating cell, said cell is electrically connected to said generator, and said cell is also electrically connected to said battery.

4. Electric vehicle construction as described in claims 1 or 3 wherein said hydrogen storage system contains carbon graphite as a storage medium and absorbent/desorbent.

5. Electric vehicle construction as described in claims 1 or 3 wherein said hydrogen storage systems contains metal hydride as a storage medium and absorbent/desorbent.

6. Electric vehicle construction as described in claims 1 or 3 wherein said hydrogen storage system contains a mixture of carbon graphite, mesocarbon microbeads and metal hydride as a storage medium and absorbent/desorbent.

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~~7.~~ Electric vehicle construction which includes a body for carrying at least one passenger and an electric propulsion system with at least one electric motor, at least one battery, at least one electricity generating fuel cell system for charging said battery and/or powering said motor, and a hydrogen storage system attached to said body, and which body ~~is riding~~ rides on at least two wheels with a steering system attached to said body, the improvement wherein said hydrogen storage system contains carbon graphite as a storage medium and absorbent/desorbent.

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~~8.~~ Electric vehicle construction which includes a body for carrying at least one passenger and an electric propulsion system with at least one electric motor, at least one electricity generating fuel cell system for powering said motor, and a hydrogen storage system attached to said body, and which body ~~is riding~~ rides on at least two wheels with a steering system attached to said body, the improvement wherein
said hydrogen storage system contains carbon graphite as a storage medium and absorbent/desorbent.

9. Electric vehicle construction which includes a body for carrying at least one passenger and an electric propulsion system with at least one electric motor, at least one battery, at least one electricity generating fuel cell system for charging said battery and/or powering said motor, and a hydrogen storage system attached